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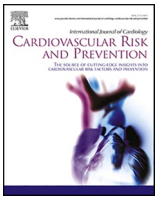

Emerging risks of microplastics and nanoplastics (MNPs): Is a silent threat for cardiovascular disease?

Dear editor,

Disclosures

All authors report no relationships that could be construed as a conflict of interest. All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

CRediT authorship contribution statement

Zeeshan Afzal: Methodology, Supervision, Writing – original draft, Writing – review & editing. **Abdul Basit:** Writing – review & editing. **Usama Habib:** Methodology. **Mateen Aman:** Writing – review & editing. **Muhammad Azim:** Methodology. **Huili Cao:** Supervision, Writing – original draft.

The global production of plastics reached 400.3 million metric tons in 2022 [1] and is constantly increasing, and this trajectory is set to persist until 2050 [2]. Once plastic is released into nature, it degrades, resulting in the development of microplastics (particles smaller than 5 mm) and nanoplastics (particles smaller than 1000 nm) [3]. Microplastics and nanoplastics (MNPs) contamination is becoming a global environmental hazard. Achieving universal health coverage has long been a common goal for governments and areas across the world [4]. Low- and middle-income countries are particularly impacted by MNP because their population are disproportionately exposed to these environmental pollutants; however, increased globalization is making it a concern for all nations [5].

MNPs can have either direct or indirect impacts on human health by entering the body directly or by serving as a carrier of environmental contaminants [6]. Emerging experimental findings have highlighted the links between possibly high exposure to microplastics and nanoplastics (MNPs) and cardiovascular risk factors, e.g., abnormal blood velocity [7].

Humans are exposed to several sources of MNPs in their everyday lives, including indoor and outdoor air, drinking water, salt, different kinds of seafood, fast food takeout, and other items packed in plastic. Several studies have found that microplastics and nanoplastics (MNPs) enter the human body via ingestion, inhalation, and skin contact, and then interact with tissues and organs [6]. MNPs cause a variety of toxicological effects on human health [3].

Preclinical research suggests that microplastics and nanoplastics (MNPs) may increase the risk of cardiovascular disease [8]. Several in-vitro studies demonstrate that particular MNPs enhance oxidative stress, inflammation, and apoptosis in endothelial and other vascular cells; animal models imply a role for MNPs in altered heart rate, cardiac function impairment, myocardial fibrosis, and endothelial dysfunction [9].

In a prospective, multicentre, observational study, 257 patients underwent carotid endarterectomy surgery and screened for atheromatous plaque. 11 MNPs were tested, polyethylene and polyvinyl chloride (PVC) were detected within the carotid plaque. Polyethylene was detected in 58.4 % of patients ($n = 150$) with a mean of 21.7 ± 24.5 μg/mg of plaque, a measurable amount of polyvinyl chloride was detected in 12.1 % of patients ($n = 31$) with a mean of 5.2 ± 2.4 μg/mg of plaque. Jagged-edge, non-organic particles were found within the plaque macrophages and in atheromatous plaque when examined with electron microscope. Radiographic examination showed that some of these particles included higher amount chlorine compared to oxygen and carbon. Patients in which MNPs were detected within the carotid plaque (atheroma) were at higher risk for a myocardial infarction, stroke or death at 3 years of follow-up after surgery than those in whom these substances were not detected [8]. This trial also showed that there is accumulation of nanoplastics at the site of atherosclerosis rather than the microplastics. If nanoplastics make the plaque more susceptible it will increase the risk of atherosclerotic cardiovascular disease (ASCVD) in the patients who have higher exposure to these pollutants.

The current trial is the first to investigate the presence of micro and nanoplastics (MNPs) in the plaque build-up of the carotid artery in humans. This raises the potential risk of airborne exposure to MNPs during the sample collection and screening process. To conclusively demonstrate the effects of MNPs on cardiovascular disease, larger-scale trials will need to be conducted in controlled, MNP-free laboratory settings.

Current trial opens a new research gap in our understanding of the precise mechanisms by which MNPs may contribute to ASCVD progression. It requires further research to fully elucidate this potential new risk factor. Additionally, People need to be more aware of the importance of reducing plastic consumption. Governments around the world should introduce and promote alternative solutions to plastic use.

With the increased evidence of MNPs for CVD raises the question of whether microplastics and nanoplastics are silent threat to cardiovascular health. Do we need to be concerned? To answer this question more efficiently larger clinical trials were needed which particularly focus on the MNPs and its relation with ASCVD.

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Zeeshan Afzal**
Department of Internal Medicine, Shanxi Medical University, China

Abdul Basit
Department of Internal Medicine, Shanxi Medical University, China
International Students Research Association of Shanxi Medical University, China

Usama Habib
Department of Internal Medicine, Shanxi Medical University, China
International Students Research Association of Shanxi Medical University, China

Mateen Aman
Department of Internal Medicine, Shanxi Medical University, China
International Students Research Association of Shanxi Medical University, Chiina

Muhammad Azim
Department of Internal Medicine, Shanxi Medical University, China
International Students Research Association of Shanxi Medical University, China

Huili Cao*
Department of Cardiology, Second Hospital of Shanxi Medical University, China
International Students Research Association of Shanxi Medical University, China

** Corresponding author. Shanxi Medical University Secondary affiliation: International Students Research Association of Shanxi Medical University. Shanxi, China.

* Corresponding author. Department of Cardiology, The Second Hospital of Shanxi Medical University, Shanxi, China.
E-mail address: zeeshancheema9263@gmail.com (Z. Afzal).
E-mail address: xdzhang7946@163.com (H. Cao).

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